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Resolving the Causal Paradox

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Resolving the Causal Paradox

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Dedication

I dedicate this work to Rob Koons and Dan Bonevac, whose generosity with their time and attention has been bottomless.

Abstract

Resolving the Causal Paraodx

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This report begins with a paradox which proceeds from roughly the following premises: (i) that every fact has a cause, (ii) that there is a fact which includes all facts, (iii) that whatever causes a given fact must cause whatever facts that fact includes, and yet (iv) that no fact can cause itself. These premises seem to entail a contradiction, since whatever causes the fact which includes all facts is itself one of the facts which the fact so caused includes, meaning that it must cause itself. Each of the four premises which generate this paradox is intuitively correct. This report resolves the paradox by describing a positive causal model on which all of the four premises have plausible and well-motivated interpretations, at least one such interpretation apiece, which are all consistently true. Much of the discussion is devoted to examining the root logical properties of causation and metaphysical explanation in order to discern which versions of these premises are in fact plausible and well-motivated. The positive model on which these interpretations are reconciled involves an infinite regress of efficient causal facts in which each subsequent fact is embedded as a remainderless proper conjunct of the fact that precedes it.

Table of Contents

Introduction: Presenting the Paradox 1

The Varieties of Explanation 4

Explanatory Fundamentality and Non-fundamentality 6

Motivations for Theses about Explanation's Logical Properties 16

- Foreshadowing: The Theses in View 16
- Explanatory Irrelevance 16

Intro to the Case against Fundamental Explanatory Looping 32

- Against Tail-Swallowing 32
- Against Hat-Eating 35

Motivating T10: One Fundamental Explanation → One Consequence 38

- First Motivation: Explaining the 'Fundamental Targeting Thesis' 38
- Second Motivation: No Fundamental Multi-object Explanations to Be Found 38
- Third Motivation: Explaining the General Targeting Thesis 41
- Fourth Motivation: The Dubious Case of Fundamental Overlap 46

A Theory of Conjunction 48

Causal Decomposition 55

Pan-Explanation 57

Argument and Puzzle 59

- Argument 59
- Puzzle 60
- Telos 62

References 66

Introduction: Presenting the Paradox

There's familiar paradox generated by a body of intuitive claims. For instance,

(P1) Every fact is explained by some fact or facts.

(P2) There's at least one Big Fact which includes all the facts.

(P3) Whatever explains one fact P explains any facts included by P.

(P4) But no fact or facts explain themselves.

Every premise here is intuitive, but embracing them all leads to a contradiction, since whatever fact explains the Big Fact (as per P1 and P2) must itself be included in the Big Fact (as per P2) and so would have to explain itself (as per P3). This result and P4 are contradictory.

This chapter resolves the paradox. The basic move is that there's a distinction between fundamental and non-fundamental explanations, as well as between causal and non-causal explanations. Any of these is an explanation simpliciter or, more succinctly, an explanation. P1 turns out to be wellmotivated for whatever sort of explanation: fundamental, non-fundamental, causal, non-causal and simpliciter. So we must continue to embrace this premise without softening it up. P2, by contrast, doesn't say anything about explanations, so the distinctions I'm drawing among multiple sorts of explanation don't have any effect upon P2. We end up needing to accept P2 in just the form in which it's already been stated.

P3 and P4 are different, however. In the form they're stated above, they are both too strong. P3 must be revised to be only about causal explanations:

(P3*) Whatever causally explains one fact P causally explains any facts included by P.

As for P4, it turns out to be true for fundamental explanation, but not for non-fundamental explanation or explanation simpliciter. So it should be revised to read as follows

(P4*) No fact or facts fundamentally explain themselves.

As distinguished from P3* and P4*, P3 and P4 themselves are not well motivated. Against P3, there's at least one sort of fact that can be explained by some things that don't explain everything that fact includes. For instance, the conjunction P&Q includes the conjuncts P and Q. Ordinarily, such a conjunction is explained by its conjuncts P and Q even though those conjuncts do not explain themselves. So P&Q is explained by some things (namely, P and Q) which do not explain some things included by P&Q (namely, P and Q). This result contradicts P3.

As for P4, while it is true that no fact or facts fundamentally explain themselves --- and so, insofar, P4 is correct --- there is a certain sort of fact which could, consistently with P4*, non-fundamentally explain itself. P4 rules out such self-explanation even in the case of this special sort of fact, but P4* (which as I argue below, we should accept in lieu of P4) allows it to exist.

The structure of the fact which does this self-explaining is surprising. It's a kind of 'self-embedded, remainderless infinite regress' --- which I will fondly denote as a *really explanatory regress*.[1] Its existence provides a positive model which reconciles the intuitive premises P1, P2, P3* and P4*.

[1] My thanks to Daniel Bonevac for suggesting this phrase.

The next section of my paper shows why we ought to accept P1 through P2, as well as P3* and P4*. Then I point out the difference between P3 and P4 and the other premises. I explain why even though we ought to accept P1 and P2 in their full-blooded versions, P3 and P4 are not well-motivated and we ought to accept not them, but rather the revised theses P3* and P4* in their place. Finally, I'll explain what I mean by a 'really explanatory regress' and show how such a regress lets us reconcile P1, P2, P3* and P4*.

The Varieties of Explanation

The very first thing is to explain what I mean by explanation.

I'm not talking about 'explanations in dialogue.' (See, e.g., Achinstein 1983.) In my sense of explanation, an explanation is not a series of sentences in a spoken language which clarify, or are intended to clarify, something for a person who is listening. Explanations like that are context-sensitive: what works as an explanation for one person will not necessarily work as an explanation for someone else. Also, those explanations consist of words. My explanations aren't like that, on either count.

Instead, I'm talking grounding (e.g., Fine 2010, 2012a, b; Rosen 2010; Raven 2012; Correia and Schnieder 2012; Trogdon 2013; Litland 2015; Berker forthcoming) and efficient causation (e.g., Salmon 1984, 1998; Woodward 2005) which, lumped together, might be referred to as the category of metaphysical explanation. Efficient causing is, for instance, the bringing about of the fact that the ground is wet by the fact that it just rained. Grounding is, for instance, the bringing about of P&Q by P and by Q, or the bringing about of PVQ by P (Correia 2010).

Metaphysical explaining is not very context-sensitive. It may depend in some cases upon metaphysical contexts such as times and possible worlds, or even upon 'reference frames' in the sense in which this term is used in the physical theories of Special and General Relativity. But it does not ordinarily depend upon the mere interests and instincts and other psychological properties of any people who are conferring and deciding what 'explanation' ought to be used to account for something. There is a right and wrong answer about whether a given fact does any causing/grounding (that is,

metaphysical explaining) towards another given fact. The rightness or wrongness of the answer is, at least ordinarily, context-independent.

The idea of metaphysical explanation is related to sufficient reasons and much of what I say can be translated into those terms. It seems, however, that efficient causation may sometimes be non-sufficient. (Cf. Mackie 1965, 1974, 1988 for arguments that causes are insufficient but non-redundant parts of a condition which is itself unnecessary but sufficient for the occurrence of the effect.) A cause might bring about an effect (say, in quantum mechanics) without requiring that effect. I'm making no determination here about whether non-sufficient efficient causings can happen, but my sense of explanation will include both sufficient and non-sufficient causings if they do. It's also meant to include some non-causal cases of explanation, i.e., grounding. For instance, if P and Q facts, then they are the typically an explanation for any combined fact (say, P&Q) they compose.

Explanation is, in my sense, a relation from facts to facts. (See Fine 1982 for an analysis of facts.) So,

(D1) An explanation is an explanatory relation from some fact or facts (the premises) to some fact or facts (the consequences) which the premises explain (i.e., ground or efficiently cause).

Explanatory Fundamentality and Non-fundamentality

Some explanatory relations are explanatory in virtue of other such relations. For instance, if P causes Q and then Q causes R, it is typically the case (maybe always the case; but see Woodward 1984, 2003, Lewis 2000, Hall 2000, Hitchcock 2001, Maslen 2004, and Paul and Hall 2013) that P causes R. It does so, however, because P caused Q and Q caused R. The explanatory relation from P to R is explanatory because of two other explanatory relations. Explanations which aren't like this --- which don't explain in virtue of some other explanations --- are 'fundamental.'

(D2) An explanation is fundamental iff there are no other explanations such that it is explanatory solely in virtue of them.

Fundamental explanations are the building blocks, the ground level, of which other explanations consist.[2]

(D3) An explanation is non-fundamental iff it is not fundamental.

Non-fundamental explanations, as the form of the word indicates, are just all the explanations which are not fundamental ones.

I think there are two, and only two, types of non-fundamental explanations. The first is an explanation by transitivity, or ebt.

(D4) A given explanation E is an explanation from transitivity, or ebt, iff E is explanatory solely in virtue of some other transitive series of explanations the first

[2] Unless there's explanatory gunk: an infinite series of explanations each of which is explanatory solely in virtue of some others further down the series, and without any fundamental explanations waiting beyond the whole infinite regress. In that case, the definition given for 'fundamental explanation' is still correct, but explanatory gunk (and only explanatory gunk) fails to have fundamental explanations as its 'building blocks.'

of which has exactly the same premises as E and the last of which has exactly the same consequences as E.

For instance, suppose P explains Q and Q explains R and, further, P explains R wholly in virtue of these two other instances of explaining. That makes the explanation of R by P an ebt.

An ebt might also have multiple premises or consequences, and the explanations in the transitive series which grounds it might have multiple premises and consequences as well. For example, suppose:

(i) P and Q explain R;

(ii) R explains S and T; and

(iii) T explains U and V.

In this case, it's plausible that P and Q explain U and V and that they do so solely because of the more basic explanations (i) – (iii) listed above. If that's so, then there is an ebt (explanation by transitivity) from the premises P and Q to the consequences U and V.

I don't insist that the relationship of explaining is, in fact, transitive. (See e.g., Schaffer 2012, Litland 2013, Loss 2015, Rodriguez-Pereyra 2015.) I think it very plausible, however, that it is. If it is, or if there are any cases like the last two I have mentioned in which some premises explain some consequences solely in virtue of another more basic transitive series of explainings, then those cases are all non-fundamental explanations of the sort I've called ebts.

If there aren't any cases like this, then there are no ebts. The nonexistence of ebts would not cause any problem for the argument of this chapter. It's implausible that

there are none, but if there are none, there is still one other type of non-fundamental explanation.

(D5) A given explanation E is a conglomerate explanation iff there are some other explanations such that E is just them 'put together'; in other words, E consists exhaustively of some other explanations.

Let me give an example of how this works and clarify a few confusing details.

First, suppose P explains Q and P also explains R, and Q and R are not the same fact. In a case like this, P explains each of two different consequences. So there are two numerically distinct explanations here. The first is an explanation whose only consequence is Q and for which P is the only premise: this is an explanation of Q by P. The second is an explanation whose only consequence is R and for which P is the only premise: this an explanation of R by P. Since Q and R are not the same facts, these two explanations cannot be the very same token explanatory relation.

In such a situation, the sentence "P explains Q and R" is true on at least one reading. If there is a reading of "P explains Q and R" on which it is true because of a token explanatory relation whose subject (i.e., explanans) is P and whose objects (i.e., explananda) are Q and R, then by the definition of 'explanation,' that token relation is a single explanation whose only premise is P and whose consequences are Q and R.

I think there are explanations like this and that they consist of simply the more fundamental explanations put together. In the case we've been considering, there is an explanation whose only premise is P and whose consequences are Q and R. But this is not a 'new' explanation which exists over and above the others taken jointly. It is simply the more basic explanations --- the explanation of Q by P and the explanation of R by P -

-- in some sense ‘put together.’ It consists of them exhaustively in a way which is at least analogous to the way in which a chimney consists exhaustively of some bricks and mortar.

Here’s a fleshed out case. Let

P := It was raining.

Q := The ground is now wet.

R := The roof of my house is now wet.

Here we have at least two explanations: P explains Q, and P explains R. The fact that it was raining explains the fact that the ground is now wet. The fact that it was raining also explains the fact that the roof of my house is now wet. What’s more, there is a third sentence which is also true: “The fact that it was raining explains the fact that the ground is now wet and the fact that the roof of my house is now wet.” I think this third sentence does, or can, express an explanation which is just the first two explanations put together. This explanation would be one whose two consequences were the fact that the ground is now wet and the fact that the roof of my house is now wet, and whose only premise was the fact that it was raining.

If there are such explanations --- explanations which consist exhaustively of other explanations --- then these are the explanations I mean by “conglomerate explanations.”

Every explanation, then, is a token explanatory relation among facts; and we have arrived at a taxonomy among three sorts of explanations:

(i) ‘Fundamental’ explanations, which do not succeed in being explanatory solely in virtue of any other explanations.

(ii) Non-fundamental ‘explanations by transitivity’ (or ebts), which are explanatory solely in virtue of a transitive series of other explanations.

(iii) Non-fundamental ‘conglomerate’ explanations, which exhaustively consist of some other explanations put together.

I think there are some explanations of all three kinds. I.e., none of these three categories is empty. I haven’t proven that. I also think there are no other types of explanation besides these. That is, I think the only way one explanation can succeed in being explanatory in virtue of the explanatory natures of some other explanations is for it to succeed either through those other explanations’ formation of a transitive series or by outright consisting of those other explanations. I haven’t proven this either.

I use ‘PP’, ‘QQ’, etc., as variables in a logic of plural quantification. (See Boolos 1984, Lewis 1991, Rayo 2002, Linnebo 2003, Sider 2007.) To further explore the categories of fundamental and non-fundamental explanations, let’s first define some propositions PP as discrete iff they meet all three of the following conditions:

i. the propositions PP are all numerically distinct from each other,

ii. none of the propositions PP has any of the others as a conjunct, and

iii. there are no propositions QQ such that one of the PP’s is the conjunction of those QQ’s even though each of those QQ’s either is, or is a conjunct of, at least one of the other PP’s.

I’ll give some examples to elucidate what this definition comes to. First, P and P are not discrete because they violate the first condition on discreteness of propositions: they are numerically identical. P&Q and P are not discrete for another reason: they violate the second condition, since one of them has the other as a conjunct. The third

condition is the most complicated. It excludes the trio of propositions P&Q and P&R and Q&R from counting as discrete. In this case, the problem is that one of these three propositions, P&Q, consists of two propositions P and Q *each* of which itself is a conjunct of some other propositions (P&R and Q&R) in the original trio. The third condition on discreteness forbids a discrete set of propositions from including one which exhaustively divides into conjuncts already included by the others.

However, any non-conjunctions are discrete as long as they're numerically distinct from each other; and if P and Q and R are discrete, then so are P and Q&R.

The definition of 'discrete' lets us discuss some key cases of fundamental and non-fundamental explanatory relations:

(1) &-introduction from two discrete facts to their conjunction

&-introduction among discrete propositions is explanatory, since a conjunction's discrete conjuncts explain that conjunction. This is witnessed by the fact that when P and Q are discrete, you can respond legitimately and correctly to the question "Why does P&Q obtain?" by giving the answer "Because P obtains and Q obtains." As an 'explanation in English' rather than a metaphysical explanation, this reply is not very deep, informative or interesting. Strictly speaking, however, it is correct. Just as a chimney exists metaphysically-because (or, at least, partly metaphysically-because) of its constituent bricks and mortar, so a conjunction of discrete conjuncts obtains because of those conjuncts. The correctness of this 'explanation in English' witnesses the existence of a genuine metaphysically explanatory relationship from discrete conjuncts to the conjunction they compose.

&-introduction among exactly two facts is *fundamental* in the sense I defined above, since the instance of &-introduction from P and Q to P&Q does not succeed in being explanatory through depending on any other explanatory relations.

Besides this, there are other like cases: e.g., P and Q might fundamentally explain the fact that at least two of P and Q obtain.

(2) V-introduction from a fact to the disjunction of it and some proposition with which it is discrete

Why is it the case that P or Q? Because P. We might then ask why it is the case that P, but arguably some explanation of P or Q has already been achieved just by the initial answer. So it is arguable that this inference is explanatory, and it is plainly fundamental.

Besides this, there are other like cases: e.g., P might fundamentally explain why it is that at least one of P and Q obtains.

(3) Fundamental causal inference

Causal explanation is a special sort of explanation, since some explanations are causal and some are not. &-introduction, for example, is never causal. There are cases where P causally explains Q and the causal inference from P to Q does not obtain in virtue of any other more basic explanatory relations. In these cases, the explanation of Q by P is a fundamental causal relation.

An example of a fundamental causal relation might be the inference to a given spatiotemporal event e (or the fact that e occurs) from the conjunction of all the events in some adjacent time-slice of e's pastward lightcone.

As a more pedestrian example for a looser sense of 'explanation,' the causal explanation of the fact that the ground is wet is often the fact that it has been recently raining.

(4) Set theory, existence, and minds

The following examples are less obvious and I won't be appealing to them further until late in the chapter. However, we might hold that either there is a fundamental explanatory relation from a fact P to the existence of P, or else vice versa. For this to work, though, propositions must not be the sorts of things which can be false. Instead, the false things would have to be exclusively sentences and something like the following would need to be true: what it is for a sentence to be false in a given language and context is for it to be well-formed in that language but for there to be no proposition it expresses in that context. This is a very Russellian theory of propositions, where's there's apparently no difference between a proposition and the entities it is about.

We might also suspect there to be a fundamental explanatory relation from the existence of x to the existence of the singleton of x (or vice versa).

Lastly, we might hold that certain mental acts explain the existence of some of their token contents. E.g., the fact that you perform a particular act imagining a tomato might explain the fact there exists a certain tomato trope (the one through which you are imagining a tomato).

(5) Parts and Wholes

This fifth case requires there to be an explanatory relation from the proper parts of an object to the whole those compose, or vice versa. (See Lewis 1991, Sider 2007.) I

will not insist on this case in the present argument, although it may provide support via considerations of analogy to the explanation of a conjunction by its conjunts.

Beyond these five sorts of cases, I do not know any plausible examples of fundamental explanatory inferences --- nor do I insist on all the ones I've mentioned. There are also, however, some fundamental non-explanatory inferences. The most obvious are: self-implication, &-elimination, and reverse causal inference (a relation from an effect to what causally explains it).

There are also non-fundamental explanatory inferences. For instance, consider some discrete propositions P and Q where P explains Q. There is an explanation, but not a fundamental explanation, from the premise P to the consequence P&Q:

P (premise)

Q (inferred from P, since P explains Q)

P&Q (inferred from lines 1 and 2 by &-introduction)

This explanation is non-fundamental because two subsidiary explanatory inferences are involved, and the explanatory success of the whole inference derives solely from the explanatory successes of these two subsidiaries. By contrast, a fundamental explanation consists of just one explanatory inference.

Suppose instead we had reasoned like this:

P (premise)

P&Q (inferred from P according to the following rule: Infer from X the conjunction of X and any proposition which X explains)

Even though this explanation used just one inference, it is still not a fundamental explanation, since the inference in question was not a fundamental one. I don't wish to

spill much ink teasing out the exact sense in which the explanatory success of the inference of P&Q from P, in the above case, obtains ‘solely in virtue of’ the success of the more fundamental inferences from P to Q and then from P and Q to P&Q. It is obvious that in some sense it does so. This disqualifies the inference (and so the explanation) from being a fundamental one. What is important here is that there is a distinction between fundamental and non-fundamental explanatory inferences, not that we have a complete account of what the difference comes to. We don’t have that, since we don’t have a real definition of the ‘obtains in virtue of’ relation between some non-fundamental explanatory inferences and other fundamental ones.

There is, lastly, non-fundamental non-explanatory inference --- but this is boring.

Motivations for Theses about Explanation's Logical Properties

FORESHADOWING: THE THESES IN VIEW

The next large section of this essay will be spent explaining and providing positive motivation for five major theses about the logical properties of metaphysical explanation. They are as follows:

(T1) No explanation has an *irrelevant* premise.

(T2) Fundamental explanation never *eats its own tail* (there is no instance of the transitive closure of fundamental explanation which includes all of its consequences among its premises).

(T3) For any facts, there is some fact which *conjunctively gathers* them (i.e., each of those facts either is it or is one of its conjuncts).

(T4) Any fact which causally explains a conjunction causally explains each of its conjuncts.

(T5) For every fact, there is a causal explanation.

I will later use these theses to motivate a specific positive model on which they are all consistently true, by way of showing how difficult it is to find any other model that reconciles them.

EXPLANATORY IRRELEVANCE

The first thesis is about *explanatory irrelevance.* Let me introduce this notion by example.

Suppose you start with a fact P1 which explains Q, and you try 'tacking on' a new premise P2. Do you automatically end up with a new explanation for Q when you do this, one which has two premises: P1 and P2?

Let's look at a specific instance of the 'tacking on' procedure:

1. It has been raining. (premise)
2. Therefore, the ground is now wet. (inferred from line 1 through causation)

The causal inference from the fact in line 1 to the fact in line 2 is a metaphysical explanation. Suppose you try to move from this explanation to the following more complex inference:

1. It has been raining. (premise)
2. Fermat's Last Theorem is true. (premise)
3. Therefore, the ground is now wet. (inferred from lines 1 and 2)

In making this move, we started from one metaphysical explanation for the fact that the ground is wet (the explanation of that fact from the fact that it has been raining), and then we 'tacked on' another premise: the fact that Fermat's Last Theorem is true. We end up with an inference from two premises to the same conclusion we originally reached: the fact that the ground is now wet. One of the two premises is still the causal premise we used the first time: the one about rain. However, the other premise is a fact about Fermat's Last Theorem. I think it is intuitive that the inference from these premises is not a grounding or causal explanation for the fact that the ground is wet. (The inference is inexact in Bolzano's (1973, 2004) terminology; but exactness in his sense is neither necessary nor sufficient for explanatory inference.)

If you are asked "Why is the ground wet?" and you answer "It's wet because of the fact that it's been raining," you have given a correct and relevant answer. If instead you respond, "It is wet because of the fact that it's been raining and the fact that Fermat's Last Theorem is true," then I'm not sure what motivated you to respond that

way. Perhaps you did it only because you were forcibly recruited into a hypothetical example. At any rate, I think such an answer does not, or not the whole of it, succeed in expressing a causal explanation for the fact that the ground is now wet.

Neither does it express a grounding explanation. “The ground is wet because there are innumerable particles of H_20 which form a layer of water on the surface of the ground” may express an explanation-via-grounding for the fact that the ground is wet. An answer involving Fermat’s Last Theorem does not.

So on my view, lines 1 and 2 of our second inference compose neither a causal explanation nor an explanation by grounding for the fact that the ground is wet. Nor any sort of combination of causal explanation and explanation by grounding. The inference from 1 and 2 to 3 is not, in the metaphysical sense, an ‘explanation’ at all.

I think this assessment of the case is intuitively correct. But if it is right, the question arises: Why isn’t the second inference an explanation? What is it about explanations which prevents that inference from being one? The short answer is:

> ‘Relation from facts to facts in which every premise does some metaphysical work toward at least one of the consequences’ is part of what we *mean* by ‘instance of causation’ and ‘instance of grounding’ and, hence, by ‘metaphysical explanation.’

That condition, of course, is not satisfied for the above inference, because the Fermat premise does no metaphysical work toward the object of the conclusion, the fact that the ground is wet. The example, then, illustrates how an inference can fail to be explanatory because it includes a premise which is *irrelevant*.

The long answer as to why the second of the two above inferences fails to be explanatory is, well, longer. It begins with the following theory:

(T6) There is an intuitive notion of 'explanatory work' which has all the following properties:

(i) Explaining a given consequence is a way of doing explanatory work toward that consequence;

(ii) Cooperating with some other premises to do the work of explaining a given consequence in a given explanation is itself a way of doing explanatory work in that explanation;

(iii) If P and Q explain R, then in that explanation, either

i. each of P and Q explains R, or else

ii. P and Q cooperate to do the work of explaining R.

I think the first two clauses of T6 are fairly obvious. The third clause, which I take to be intuitively right, does the main work here. It deserves a little restatement:

If there is a real explanation from P and Q to R, then P and Q must somehow each be involved in the work of explaining R. Each of P and Q being involved in the work of explaining R is part of what it is for P and Q to explain R. If, for instance, Q was not involved in the work of explaining R, then it would not be the case that P and Q explained R. At best, in that situation, it would only be the case that P explained R. Whether the instance of explanation in question is one of causation or one of grounding, saying that P and Q explain R implies that Q is somehow involved in the work of R's explaining.

There are only two ways P and Q might both be involved in explaining R: they might either explain R individually (that is, they each explain R: P explains R, and Q explains R) or they might explain R in cooperation. So either each of P and Q explains R, or else P and Q cooperate to do the work of explaining R.

I take this defense of (iii) --- which is largely just a reiteration of (iii) in different words --- to be intuitive. To the extent it seems intuitive, however, that (iii) might be false, I suspect this results from semantic slippage between the most basic sense of '… explain …' (which we might dub '… explain$_1$ …') and a second derivative sense '… explain$_2$ …'. When in this second sense we say "P and Q explain R," we mean something like "If you have P and Q, then you have what explains$_1$ R" or more simply "P and Q include something which explains$_1$ R," "Some explanation$_1$ of R goes on in P and Q." All may well be true --- and often is true --- in cases where P explains$_1$ R but Q has nothing to do with it.

For example, the facts that it rained in Georgia just now and that there was a meteor strike on Pluto two seconds ago cause the grass to be watered just now in Georgia. But they cause it only in the sense that they include something that causes it. That is, they cause$_2$ it only in the sense that they include something which causes$_1$ it. The fact that it rained in Georgia causes$_1$ the grass there to be watered. The meteor strike on Pluto (at least in the short term) neither causes$_1$ nor causes$_2$ it.

To make sense of this sort of claim --- "they cause it in the sense that they include something that causes it" --- we must have two different senses of causation. If there were only one, it would make no sense to explicate one instance in terms of another such instance. "They cause it in the sense that they include something that

causes it" only casts light on the meaning of the first instance of "cause" if it explains that instance in terms of a different meaning of the second instance. If the meaning of the second instance were merely the very same as that as the first instance, then such an assertion would leave us no closer to understanding that meaning.

The theory that there are two meanings here allows us to hold onto both sets of intuitive motivations about the cases which T1's third clause involves. When it seems intuitive that T1's third clause is true (that is, when it seems intuitive that in order for an inference to be an explanation, each of its premises must do some explanatory work in explaining the consequences), then this is because we are then construing T1 in the more basic sense of '… explain …', namely '… explain_1 …'. (That is the sense in which the rain, but not the rain and the meteors, explain the well-wateredness of Georgia's lawns.) Such intuitions do exist. There is an intuition that it is not the case that the grass being watered now in Georgia is caused by the facts that it's raining there and that there were recently some meteor strikes far outside of Georgia's lightcone. Taken together, the existence of '… caused_1 ...' (and hence '… grounds_1 …' and '… explains_1 …') and the truth of T6 account for and vindicate this intuition.

By contrast, in considering the claim "The fact that Georgian grass is now being watered is caused by the fact that it's raining there and the fact that there were some meteor strikes two seconds ago several light-hours away," if we can get ourselves in the mood where such a saying seems plausible, then those intuitions can be explained and vindicated by the theory that there is also another sense of the verb '… caused …', namely '… caused_2 …', which reduces to '… caused_1 …' by the formula I have offered (for x and y to cause_2 z is for them to include some thing or things that cause_1 z).

By having both these readings of ‘cause’ --- and ditto for ‘explaining’ and ‘grounds’ --- we get to keep both sets of intuitions. If we only had one reading, we would have to throw out one set of intuitions or the other. The most plausible theory, then, is that both readings of these terms are available. For this essay, though, all my remaining uses of this terms will be given the stronger, more basic reading (‘explains$_1$’, ‘causes$_1$’, etc.). As I am using the terms, the third clause of (iii) is probably true: it is intuitive, and the force of our main reason to doubt it is defeated by the existence of an alternate interpretation of the intuition that causes the doubts. However, to the extent we accept other assumptions later in the chapter based on their intuitive force, we must be careful to be sure that this force supports the correct reading of those assumptions.

Thus the case for T6. To put T6 to use, though, I’m going to have to chop some logic very finely.

First, let’s consider a hypothetical explanation. We will call it E1 and stipulate that both of following conditions are met:

(Condition A) In E1, P and Q explain R.

(Condition B) However, Q does not explain R. It does so neither in E1 nor as the sole premise of any other explanation of R.

For instance, to satisfy these conditions, P and Q might be two discrete conjuncts which cooperate to explain R, where R is the conjunction P&Q. In such a case, P and Q cooperate to explain R by &-introduction, and yet Q does not explain R at all.

By stipulation: in E1, P and Q explain R. This sets us up for an application of the third clause of T6. This clause says that if P and Q explain R, then in that explanation, either each of P and Q explains R, or else P and Q cooperate to the do work of

explaining R. So one or the other of these must be true: in the explanation in our example, either each of P and Q explains R, or else P and Q cooperate to do the work of explaining R.

Condition B rules out one of these two alternatives. B says that Q does not explain R. If Q does not explain R, then it's not the case that each of P and Q explains R. P may do so, of course, but according to Condition B, Q doesn't. So it's not the case that each of them explains R.

The other alternative is that P and Q cooperate to do the work of explaining R. Since one of these two alternatives must obtain and the first one doesn't, therefore this second one does.

So far, so good. Our result is not surprising. It is not surprising that in a given explanation from P and Q to R, P and Q cooperate to do the work of explaining R. Nevertheless, this result is important. Since in our example explanation, P and Q cooperate to do the work of explaining R, therefore in that explanation, Q cooperates with another premise (namely, P) to do the work of explaining R. This conclusion provides an opportunity to apply the second clause of T6, which says that cooperating with another premise to do the work of explaining a given consequence is itself a way of doing some explanatory work towards that consequence. If doing X is a way of doing Y, and Q does X, then Q does Y. So since in our example explanation, Q cooperates with another premise (namely, P) to the work of explaining R, therefore in our example explanation, Q does some explanatory work towards R.

We have been considering a hypothetical explanation E1 in which P and Q explain R. What we have learned about this explanation is that in it, Q does some explanatory work towards R. That is,

(T6) If Conditions A and B are satisfied for a given explanation E1 from P and Q to R, then in E1, Q does some explanatory work towards R.

This is our first lemma. To get the second one, consider some other explanation --- any other explanation you choose --- and call it E2.

There are two exclusive and exhaustive logical possibilities about the way that E1 and E2 are related: either

(a) All the explanatory work towards R which Q does in E1 also goes on in E2; or else

(b) Some explanatory work towards R which Q does in E1 does not goes on in E2.

We can certainly find cases where possibility (b) is the case. For instance, suppose E2 is an explanation among premises and consequences about some situation or topic completely unrelated to P, Q and R. Then whatever explanatory work towards R Q does in E1 will, almost certainly, not go on in (or have much of anything to do with) E2.

It is harder to find examples of possibility (a), though I think we can do it. For instance, suppose P and Q not only explain R, but they also explain some other discrete consequence S. Now we have not just our initial explanation E1 in which P and Q explain R, but also another explanation, call it E*, in which P and Q explain S. I think that in this sort of case, there is a third, conglomerate explanation: one in which P and Q explain the conjunction R&S. In this third explanation (call it E2), all the explanatory work

goes on which went on in either of the two constituent explanations E1 and E*. So here E2 would be an explanation which satisfied possibility (a).

The possibility which is important for our discussion is (b). I am going to rename it:

(Condition C) Some explanatory work towards R which Q does in E1 does not go on in E2.

Let's stipulate that in our hypothetical explanation, possibility (b) --- that is, Condition C --- obtains. Now, in any given explanation x whose consequence is R, x's premises succeed in explaining R at least partly in virtue of whatever explanatory work towards R goes on in that explanation. So if there is some explanatory work which goes on in E1 but which does not go on in E2, then in E1, the premises of E1 succeed in explaining R at least partly in virtue of this explanatory work. Condition C says this is in fact the case: there is some explanatory work which goes on in E1 but which does not go on in E2. Therefore according to Condition C, in E1 the premises of E1 succeed in explaining R at least partly in virtue of some explanatory work which does not go on in E2.

I take this result --- "in E1, the premises of E1 succeed in explaining R at least partly in virtue of some explanatory work which does not go on in E2" --- as guaranteeing that in E1, the premises of E1 do not succeed in explaining R solely in virtue of explanatory work which does go on in E2. If they succeed partly in virtue of X, and X is not in any sense included in Y, then they do not succeed solely in virtue of Y. This is a consequence of the use of the words 'partly' and 'solely'. 'Solely in virtue of Y' rules out 'partly in virtue of something not included by Y.' Therefore, as a particular case of this,

since in E1, the premises of E1 explain R partly in virtue of something that isn't included in the explanatory work that goes on in E2, therefore in E1 those premises don't explain R solely in virtue of that other explanatory work (the explanatory work that goes on in E2).

The premises of E1 from our example, of course, are P and Q. So the conclusion of the whole train of reasoning so far is this: Conditions A through C, taken jointly, guarantee the following further condition:

(Condition D) P and Q don't explain R solely in virtue of explanatory work that goes on in explanation E2.

We have seen that this result is entailed by the combination of three assumptions:

(Condition A) P and Q explain R.

(Condition B) Q does not explain R. It does so neither in E1 nor as the sole premise of any other explanation of R.

(Condition C) Some explanatory work towards R which Q does in E1 does not goes on in E2.

There is no way to get A, B, and C without also getting D; and we have seen, through the above chain of reasoning beginning with T6, exactly why this follows.

It is because of this entailment of D by A, B, and C that inferences with 'tacked on' premises do not, or at least not in general, succeed in being explanatory. Return to our original example of a 'tacky' inference:

It has been raining. (premise)

Fermat's Last Theorem is true. (premise)

Therefore, the ground is now wet. (inferred from lines 1 and 2)

Whatever explanatory qualities this inference may have are derivative from and dependent upon the following briefer explanatory inference:

It has been raining. (premise)

Therefore, the ground is now wet. (inferred from line 1 through causation)

If the facts that it has been raining and that Fermat's Last Theorem is true do explain the fact that the ground is wet (that is a big 'if'!), then they do so merely because the fact that it has been raining causally explains the fact that the ground is now wet. So if the two premises in the first inference succeed in explaining their purported consequence at all, then they do so solely in virtue of some explanatory work that goes on in another inference: namely, the second, briefer causal inference.

Keeping this in mind, let's make the following assignments for P, Q and R:

P := It has been raining.

Q := Fermat's Last Theorem is true.

R := The ground is now wet.

If P and Q explain R at all on this assignments, then call one of the explanations in which they do so E1. Also, let E2 denote the briefer, causal explanation from P to Q. What we have deduced is that if P and Q do explain R (if the facts that it has been raining and that Fermat's Last Theorem is true explain the fact that the ground is wet), then in this explanation E1, Condition D has been breached. Contra Condition D, in E1, P and Q do explain R solely in virtue of explanatory work that goes on in another explanation E2. If the facts that it has been raining and that Fermat's Last Theorem is true explain the fact that the ground is wet at all (a big 'if'!), they do so solely in virtue of explanatory work that

goes on in the causal inference from the fact that it has been raining to the fact the ground is now wet.

Condition D has been breached, but Condition D is entailed by the conjunction of A, B and C. So by modus tollens, not all three of those conditions obtains. Instead, if P and Q explain R at all on the assignments for these variables that we have made, then no such explanation satisfies all three of A, B and C.

At least one of these three conditions fails. Which one, though? If the inference is an explanation at all, of course, then Condition A must not fail. Condition A just says that P and Q do explain R. This is guaranteed by the claim that there is an inference from P and Q to R which is an explanation. So if the inference is an explanation at all, then the condition which fails must not be Condition A, but rather Condition B or C (or both).

By contraposition, then, if Conditions B and C do hold, then the inference from P and Q to R is not an explanation.

And this is in fact what happens.

First, with the given substitution for Q and R, B says simply, “The fact that Fermat’s Last Theorem is true does not explain the fact that the ground is now wet.” This fact is obvious. It was the whole point of choosing the truth of Fermat’s theorem as the identity of Q.

Second, if Condition A obtains, then Condition C obtains as well. It obtains because E2 has nothing to do with Q. E2 is a causal inference from the fact of the recent rain to the fact of the ground’s present wetness. There is nothing here about the explanatory influence of Fermat’s Last Theorem at all. Therefore, if the truth of Fermat’s Last Theorem does, in the context of E1, do any explanatory work toward the ground’s

present wetness (that is, the fact that the ground is now wet), then this explanatory work by the truth of Fermat's Last Theorem is work which does not go on in E2. E2 has nothing to do with it. No explanatory work from Fermat's Last Theorem to the ground's present wetness goes on in the causal inference to the ground's present wetness from the fact that it recently rained.

What C requires is for Q to do some explanatory work in E1 which is not done in E2. What we have just seen is that no explanatory work done by Q towards R goes on in E2. Therefore, if Q does any explanatory work toward R in E1 at all, then C is satisfied. And according to T2, Q does do some such work.

There is, then, no way out. If Condition A obtains (that is: if P and Q explain R), then in any explanation of that kind (for instance, E1), Q does some explanatory work towards R. But this work does not go on in E2. So, then, some explanatory work would go on E1 which does not go on in E2. In short, if Condition A obtains, C obtains as well.

So A must not obtain. We have already seen that B obtains, and so since A implies C, therefore if A obtained, then all three conditions would be true. Not all three conditions may be true because taken together they entail D, and D is false.

So A is false. Since A is out --- that is, since it is not the case that P and Q explain R --- it follows that no inference from P and Q to R is an explanatory inference. Such inferences are inferences of some kind, but not explanatory inferences. No such inference is an explanation.

In short, the property possessed by the inference from P and Q to R which rules out its being explanatory is the following: it succeeds in being explanatory solely in virtue of some other explanations, and yet it has at least one premise which does not do any

explanatory work in any of those other explanations. By reasoning generalized from that given above about P and Q and R, nothing which has this property succeeds in being an explanation. So,

(T7) There is no explanation which succeeds in being explanatory solely in virtue of some other explanations and yet has at least one premise which does no explanatory work in any of them.

Equivalently,

(T8) For any non-fundamental explanation E1, there are some other explanations EE2 (none of which is E1) such that E1 succeeds in being explanatory solely in virtue of the EE2's and for every premise P of E1, P does some explanatory work in at least one of the EE2's.

A non-fundamental explanation can have no premise which doesn't do any work in any of the other explanations which have the property that it is solely in virtue of them that the explanation succeeds in being explanatory. Such a premise would be 'tacked on.' Inferences from tacky premises are not explanations.

Of course, fundamental explanations are different. Unlike non-fundamental explanations, a fundamental explanation can have premises which do no work in any other explanations solely in virtue of which the explanation in question succeeds in being explanatory. In fact, every premise of a fundamental explanation is like and trivially so, since a fundamental explanation is simply one for which there no other explanations at all solely in virtue of which it succeeds in being explanatory.

Therefore, in considering the inference from the facts about the recent rain and Fermat's Last Theorem to the fact that the ground is wet, we were able to deduce that it

is not an explanation, partly because it was obvious that if it were an explanation, it would be a non-fundamental one. It would obviously succeed in being explanatory solely in virtue of another more basic explanation: the causal inference from the fact of the recent rain to the fact that ground is wet.

All this can be summarized succinctly in T1:

(T1) No explanation has an *irrelevant* premise.

The tacked-on premises, in the technical sense here developed, are all intuitively irrelevant to the work being done in the pseudo-explanations which include them.

Intro to the Case against Fundamental Explanatory Looping

AGAINST TAIL-SWALLOWING

Now I'm going to argue for some crucial structural facts about explanation. Here is my first:

(T2) Fundamental explanation never *eats its own tail* (there is no instance of the transitive closure of fundamental explanation which includes all of its consequences among its premises).

There are two classes of examples which support T2:

First, consider a scenario with the following structure where P and Q are, by hypothesis, discrete:

P&Q (premise)

Q (inferred from P&Q by some-or-other sort of inference)

Whichever inference rule was deployed, such an inference seems non-explanatory, or at least not fundamentally explanatorily. It is intuitive that the conjunction of two discrete propositions should not, in a fundamental way, be able to explain its own conjunct.

Let's see a more specific example. Where P := "It is raining" and Q := "I am starving," the scenario above would look like:

It is raining and I am hungry (premise)

I am hungry (inferred somehow from line 1)

In this particular example, it is obvious that the inference is not explanatory.

Might there be some other case with the same structure in which the inference is explanatory? I think not, but the following example is somewhat more compelling:

It is raining and the ground is wet (premise)

The ground is wet (inferred somehow from line 1)

Here it is less obvious whether the first line explains the second. If it did, however, it would not be a fundamental explanation. The whole reason the new example is more compelling than the last one is that the fact that it is raining explains the fact that the ground is wet (whereas neither conjunct of the original line 1 explained the original line 2). So the spelled-out inference from *It is raining and the ground is wet* to *The ground is wet*, if it is explanatory, goes actually like this:

It is raining and the ground is wet (premise)

It is raining (inferred from line 1 by &-elimination)

The ground is wet (inferred from line 2, since *It is raining* causally explains *The ground is wet*)

Even if this series of inferences were an explanation (and it isn't), it would not be a fundamental explanation since it consists not of one, but two inferences.

Suppose instead we jumped by a single inference from *It is raining and the ground is wet* to *The ground is wet*. That inference, if it was explanatory, would be explanatory solely because of the explanatory inference to *The ground is wet* from *It is raining*. So if it did explain *The ground is wet*, it would do so solely because of another explanatory inference. It follows that, by definition, the inference from *It is raining and the ground is wet* to *The ground is wet* is a non-fundamental explanation if it is an explanation at all.

I think, then, we will find no case where it is well motivated that some conjunction of two discrete propositions fundamentally explains one of its own conjuncts. Assuming this is so, T2 explains why it turns out to be so. If P and Q are discrete, then they do

explain the conjunction P&Q in a fundamental fashion: by a single application of &-introduction. If, then, P&Q also explained Q fundamentally, it would follow that P and Q fundamentally explained something that fundamentally explained Q. Therefore, P and Q would swallow their own tail: they would be all the subjects of an instance of the transitive closure of fundamental explanation all of whose objects (the only object in this case would be Q) were included among its subjects (since Q is included among P and Q). T2 says this can't happen. So it explains why the conjunction of discrete propositions never fundamentally explains any of those conjuncts.

The second examples which T2 explains are cases in which the transitive closure of fundamental explanation, if it obtained, would be reflexive. For instance, "P fundamentally explains P" or "P fundamentally explains Q, and Q fundamentally explain P." There are also instances with more than one premise and/or consequence: "P and Q fundamentally explain P and Q," "P and Q fundamentally explain R, and R fundamentally explains P and Q." I am judging these cases largely by intuition, but also by noting, sociologically, that there is a strong and entrenched intuition among both philosophers and folks that something at least usually goes wrong in purported cases of reflexive explanations. On both grounds, I hold that no case with these 'looping' structures ever obtains. That is, the transitive closure of fundamental explanation is irreflexive. That at least is true, whatever we may have to conclude about non-fundamental cases.

T2 is a well-evidenced theory. It is a single, non-conjunctive, non-disjunctive thesis about fundamental explanation which neatly explains two different classes of examples. It is better to explain these two classes of cases on the basis of a simple unified, independently intuitive theory to suppose that they are two independent truths

which just happen to lend themselves, misleadingly, to purported explanation by T2. This is especially the case that there are no other good unified explanations of these cases, besides T2, available in the offings. And finally, T2 is intuitively plausible in its own right: Apart from the classes of example I've considered, it just intuitively seems a bad idea to fundamentally explain P on the grounds that P and Q. For these reasons, T2 is probably true.

T2 forbids tail-swallowing, and if tail-swallowing is bad, hat-eating is even worse. Thus, fundamental explanation does not swallow its own hat: that is, there is no instance of the transitive closure of fundamental explanation all of whose subjects are among its objects. You will never see, for instance, a plausible example of two discrete propositions P and Q where P fundamentally explains P and Q. There is an a forteriori argument from T2 for the conclusion that such hat-eating cannot obtain: However hard it is for P to fundamentally explain itself, it should be even harder for it to fundamentally itself and another proposition. Hence, since (by T2) P can't fundamentally explain P, therefore all the more so it cannot fundamentally explain P and Q.

AGAINST HAT-EATING

A more precise account of the impossibility of hat-eating can also be given. Consider:

(T9) Whatever fundamentally explains some facts fundamentally explains each of those facts.

T9 provides a neat account of the impossibility of hat-eating. It says that any premises which fundamentally explain some consequences fundamentally explain each of those consequences. So for instance, if P fundamentally explains Q and R, then P

fundamentally explains Q. Therefore, any premises which stand in the transitive closure of fundamental explanation to some consequences stand in the transitive closure of fundamentally explaining each of to those consequences. So if P fundamentally explains Q and R, and Q and R fundamentally explain S, then P stands in the transitive closure of fundamental explanation to S. So then, in short, premises which stand in the transitive closure of fundamental explanation to some consequences stand in the transitive closure of fundamental explanation to each of those consequences.

This is bad in a case where the purported consequences include all of the purported premises --- as for instance if P fundamentally explains Q and R, and Q and R fundamentally explain P. In such a case, those premises stand in the transitive closure of fundamental explanation to each of themselves. Thus, in my example, P stands in the transitive closure of fundamental explanation to P. They stand, then, in whatever such case, in the transitive closure of fundamental explanation to at least one of themselves.

That is an instance of tail-swallowing. T2 says there is no tail-swallowing. So the conjunction of T9 with the supposition that some premises hat-eat (that is, they stand in the transitive closure of fundamental explanation to some consequences which include themselves) is inconsistent with T2. That is to say, T9 and T2, taken together, explain why no premises hat-eat.

This result is good news for T9. Prior to stating T9, we already had reason to deny that premises hat-eat: it followed by an a fortiori argument from T2. T9 now gives us a precise deductive explanation as to why it is, in fact, that they don't. Besides this, T9 follows from an even stronger claim which is independently plausible in itself:

(T10) Every fundamental explanation has exactly one consequence.

That is to say, no fundamental explanation has more than one consequence. So T9 is supported both by its success in explaining the impossibility of hat-eating *and* by being entailed by the plausible premise T10. Besides that, T9 is intuively plausible in its own right.

As for T10, it is supported by four motivations:

Motivating T10: One Fundamental Explanation → One Consequence

First Motivation: Explaining the 'Fundamental Targeting Thesis'

First, T10 does account for the truth of T9 and, through it, for No Hat-eating. T10 explains T9 by reducing it to the simplest case. According to T10, there are no fundamental explanations with more than one consequence. So then of course whatever fundamentally explains some facts explains each of them! There is no difference between explaining one fact and explaining each of those facts when there is only one fact in question.

Second Motivation: No Fundamental Multi-object Explanations to Be Found

Second, there are no plausible cases of fundamental explanatory inferences which I can think of which meet both the following conditions: they have more than one consequence apiece and they are non-causal. The only specific examples of fundamental non-causal explanatory inferences I can think of were noted above: &-introduction, V-introduction, some cases involving set theory, minds, and existence, and cases involving parts and wholes. It does not appear that any fundamental instance of any of these has more than one consequence. As for the causal inferences, I see no positive reason to think that any fundamental causal inference has more than consequence. Besides that, the following principle seems very plausible:

(T11) Any premises which causally explain some facts causally explain each of those facts.

For instance, if the fact that a new medicine is discovered causally explains the fact that John survives his illness and the fact that James survives his illness, then the fact that

the new medicine is discovered causally explains the fact that John survives the illness and it causally explains the fact that James survives the illness. This is intuitively plausible: that to bring about P and Q, you must bring about P and bring about Q.

In a case like this, however, it is not the case that P causally explains Q because P causally explains Q&R. The discovery of the new medicine does not explain the fact that John survives because it explains the fact that John survives and the fact that James survives. The discovery didn't save John by saving John and saving James! Quite the opposite: it explains the facts that John survives and that James survives because it explains the fact that John survives and it explains the fact that James survive. The causal relation is simply a case of &-introduction. It starts with the individual instances of causation and &-introduces to the combined case. It doesn't start at the combined case and somehow causally work its way back to the individual cases.

Consequently, in the present example, the causal explanation of the facts that John survived and that James survived by the fact that a new medicine is discovered is not a fundamental causal explanation. Instead, it obtains as a result of two other causal explanations: the causal explanation of John's survival by the discovery of the medicine and the causal explanation of James's survival by the discovery of the medicine.

I have considered a particular case, but we have reason to think that whenever a causal explanation has more than consequence, the 'in virtue of' relation works in the same direction: from causal explanations each with just one consequence to the causal explanation which combines all the consequence. The reason to believe this is as follows:

If T11 is true, and it is quite plausible, then there must be some explanation as to why it's true. There must be some reason why in any case where some premises causally explain more than consequence, they causally explain each of those consequences. So we should seek the best account of why this holds. The best account seems to proceed from the idea that what it is to be a causal explanation from certain premises to multiple consequences is simply to be some sort of combination of multiple causal explanations from those premises to each of those consequences. In this vein, we might hold that the causal explanation from P and Q to R and S is simply the causal explanation from P and Q to R put together with the causal explanation from P and Q to S. These last two explanations (from P and Q to R and from P and Q to S) might be 'put together' to form the larger explanation (the one from P and Q to R and S) in the sense that the larger explanation is the conjunction of the two smaller ones (the ones each of which has only one of R and S as its consequence). According to this theory, the fact that P and Q causally explain R and S is a conjunction whose two conjuncts are (i) the fact that P and Q causally explain R and (ii) the fact that P and Q causally explain S. Of course no conjunction obtains unless its conjuncts obtain. So the causal explanation of R by P and Q, as well as the causal explanation of S by P and Q, must obtain if their conjunction is to obtain. This pattern generalizes to the result that whatever premises explain some consequences explain each of those consequence (because the fact that they explain those consequences is the conjunction of the fact that they explain the first of those consequences and the fact that they explain the second of those consequences and so on).

On this sort of theory about why T11 is true, causal explanations with multiple consequences do not appear to be fundamental explanations, since according to this theory, the success of P and Q in causally explaining R and S seems to derive exclusively from the success of two distinct, subsidiary causal explanations: that of R by P and Q and that of S by P and Q. The latter two explanations are the conjuncts of which the former explanation is the conjunction, and the truth of a conjunction is explained by the truth of its conjuncts. So the truth of the conjunction is explained by the truth of some causal explanations other than itself. It is, then, non-fundamental.

So then: First, I do not know of any fundamental non-causal explanations which take more than a single object apiece, and second, the only causal explanations which take more than one consequence seem to be non-fundamental (and deriving wholly from subsidiary explanations with one consequence apiece). This argues strongly that all fundamental explanations take just one object apiece (hence T10).

THIRD MOTIVATION: EXPLAINING THE GENERAL TARGETING THESIS

Third, consider the following thesis:

(T11*) Any premises which explain some facts explain each of those facts.

This a stronger thesis than T11, which makes the like claim about causal explanations.

It is hard to see why T11 would be true except as a special case of the truth of T11*. It is hard to see why causal explanations of multiple consequences would always divide into individual causal explanations of each consequence, while other types of explanations did not do so. So the truth of T11 supports the truth of T11*.

It is non-fundamental cases that drive the argument here. According to our account of T11, you cannot take just any two different causal explanations with different

premises and consequences than one another and put them together to form a single larger causal explanation. If you could, then what would be the premises of the resulting explanation? All the premises which appear in either of the subsidiary explanations? If so, though, some of the premises will be explanatorily irrelevant to some of the consequences of the other explanation. Therefore, by T11, there will be an explanation for those consequences some of whose premises are causally irrelevant. But this, by T1, is not allowed.

It seems, however, that the only plausible explanation as to why the conjunction of two such premise- and consequence-differing explanations would not be a causal explanation is that it would not be an explanation at all. If it were an explanation, then it would be causal, since all the inferences it involved would be causal. But why would it not be an explanation? A proposed answer: What it is to be an explanation from some premises to multiple consequences is to be the combination of some one-consequence explanations for those individual consequences each of which begins with those same premises. If this is true, however, then not just T11, but T11*, obtains.

So the intuitive motivation for T11 does double duty: it is also motivation for T11*.

Second, T11* permits the following plausible metaphysics of tokens of explanation with multiple consequences: they are just conjunctions of tokens of explanations with single consequences. How do you get an explanation whose objects have an arity of two? Just conjoin two explanations with the same premises as each other and whose consequences have arities of one. Likewise for larger arities than two, include infinites.

Thirdly, it is intuitively dubious whether any discrete propositions P and Q and R can be explanatorily arranged such that P and Q are the premises of an explanation (whether fundamental or not) whose consequences are Q and R. For consider a particular example:

> That it was raining and that the ground is wet are the premises of an explanation for the facts that the ground is wet and that I slipped.

It is dubious whether this is a real explanation for two reasons: (i) in it, suspiciously, Q appears as both a premise and a consequence and also (ii) in response to the question "Why is it that the ground is wet and that I slipped?", the response "Because of the facts that the it was raining and that the ground is wet" seems off. "Because of the fact that was raining," by contrast, is intuitively correct.

T11* helps here. It entails that if some discrete propositions P and Q did explain Q and R, then P and Q would explain Q. But at least in most cases, P and Q do not explain Q, since Q is ordinarily explanatorily irrelevant towards Q. In fact, if Q was not explanatorily irrelevant to Q, it could only be because P and Q were such that there was some fundamental explanatory inference from them to Q. When P and Q are discrete, however, fundamental explanation of Q by P and Q is ruled out by T2, the prohibition on fundamental explanatory tail-swallowing.

So then, T11* in conjunction with T2 successfully explains why the dubious case of explanatory overlap among discrete propositions is ruled out even for non-fundamental explanations. That is, they explain the truth of the following thesis:

(T12) Discrete explanations do not double-back: There is no explanation whose premises and consequences are all discrete from one another and which has some proposition as both a premise and consequence.

This is the sort of case whose success in being genuinely explanatory is denied in denying that the fact that the ground is wet and that I slipped are the consequences of an explanation whose premises are the facts that it was raining and that the ground is wet.

As a fourth source of evidence for T11*, T11* is intuitively plausible in its own right.

There is, however, one crucial objection to this thesis. Suppose there are two facts, P1 and P2, which respectively explain Q1 and Q2. That is, P1 explains Q1, and P2 explains Q2. If in such a case, P1 and P2 are the premises of a single explanation which has Q1 and Q2 as consequences, then T11* entails that P1 and P2 are the premises of an explanation whose only consequence is Q1, as well as being the premises of an explanation whose only premise is Q2.

Let's flesh this ought with a particular case. That I was hungry explains the fact that I am eating. That it was raining explains the fact that the ground is wet. So, then, do the facts that I was hungry and that it was raining explain the facts that I am eating and that the ground is wet? According to T11*, if they do explain these in a single two-consequence explanation, then the facts that I was hungry and that it was raining explain the fact that I am eating *and* they explain the fact that the ground is wet.

But this is not allowed. The fact that I was hungry is explanatorily irrelevant to wetness of the ground. So by T1 ('no irrelevant premises'), the fact that I was hungry cannot be a premise of any causal explanation for the fact that the ground is wet.

This case makes it look, then, like T11* stands in contradiction with T1. With this in mind, the only way to sustain T11* is to deny that it is generally the case that when P1 explains Q1 (I was hungry explains I am eating) and P2 explains Q2 (It was raining explains The ground is wet), then P1 and Q1 are the premises of a single explanation whose consequences are Q1 and Q2 (I was hungry and It was raining explain The ground is wet and I am eating). Therefore we may not expect to succeed in, willy-nilly, grouping the premises and consequences of pre-existing explanations together in order to end up with further explanations.

What is worth considering is whether this result --- the fact that we can't usually generate explanations just by gathering all the premises and all the consequences of whatever more basic explanations we like --- is counterintuitive. Because, of course, we do say and say correctly such things as "The two greatest economic downturns of the 20th century were caused by two different, but similar, factors." If this is taken to mean "There is a single explanation from two unrelated though similar premises to two distinct consequences," then T11* must be wrong; for that is exactly the sort of combined explanation whose existence T1 and T11*, taken together, rule out.

Fortunately, there is another intuitive read on this sort of case. When I say "The two economic collapses were caused by two different factors," what I take myself to be meaning is that one factor explained one downturn and another factor explained another downturn. This is consistent with T1 and T11*. I don't see any need to take myself, in

addition, to be asserting that there is some single explanatory pathway by which both of those factors cooperated to bring about both those downturns. Unless there is some reason to think that I am saying that (and there isn't!), then there's no reason to think this sort of case counts against T1 and T11*.

So, then, in sum, T11* is supported by the preexisting support in favor of T11 (since it seems that if one is true, the other probably is as well), by further intuitive support in its own right, by the straightforward metaphysical account it provides of explanations whose objects have arities greater than 1, and by the fact that together with T1, it accounts for the impossibility of discrete explanations (fundamental or otherwise) which exhibit overlap between their premises and conclusions. Nor am I aware of any strong reason to doubt T11*.

As with T11 and causal explanations, however, the best account as to why T11* turns out to be true is that every explanation E with multiple consequences consists of, and explains solely in virtue of, some other explanations all of which have same premises as one another (and as E) and each of which has only a single consequence. From this account of T11*, it follows that any explanation with more than one consequence is non-fundamental. So there is much support for T11* and no good objection to it, and T11* probably implies T10.

FOURTH MOTIVATION: THE DUBIOUS CASE OF FUNDAMENTAL OVERLAP

Finally, it is intuitively dubious that there is any fundamental explanation whose premises and consequences overlap, whether or not those premises are discrete, as if P and Q were the premises of a fundamental explanation whose consequences were Q and R. T10 explains, as straightforwardly as you like, why there is no overlap of this

kind: because either the overlapping fundamental explanation would have just one consequence and so such explanation is ruled out by T2 (the ban on tail-eating) or else it would have two or more consequences, which T10 says no fundamental explanation can have. So T10 achieves explanatory success is ruling out the dubious case of self-overlapping fundamental explanation.

A Theory of Conjunction

My next assumption has to do with the nature of conjuncts. I think there is really no difference between the propositions P&Q and P&(P&Q). I have written two different sentences in a formal language, but each of these sentences, “P&Q” and “P&(P&Q),” expresses the same proposition. The metaphysics ignores the parenthesis.

It follows from this premise --- that Metaphysics Ignores Parentheses (MIP) --- that every conjunction is a conjunct of itself. Indeed, every conjunction is a conjunct of a conjunct of itself, since P&Q = P&(P&Q) = P&(P&(P&Q)).

MIP is not a special thesis about conjunctions being conjuncts of themselves. It does more than that. It precludes trivial distinctions among the referents of other sentences with the same ‘ultimate’ conjuncts. For instance:

(i) P&Q&R

(ii) (P&Q)&R

(iii) P&(Q&R)

(iv) (P&Q)&(Q&R)

(v) (P&R)&(Q&R)

(vi) (P&Q)&(P&R)

(vii) P&(P&Q)&R

MIP implies that all these distinct sentences, and infinitely many others (involving more iterations of ‘&’ and ‘()’), express numerically the same proposition.

In this way, conjuncts are like parts and conjunction is like mereological summation. Given a certain object, not only each of its proper parts, but also the object itself, number among the parts of that object. Likewise, not only every ‘proper conjunct’

of a conjunction, but also the conjunction itself, number among the conjuncts of the conjunction. The analogy from parts and wholes to conjuncts and conjunctions might result from the fact that there is some determinable relationship --- say, a relation of 'being wholly present in' --- such that both parthood and conjunction inherit the same logical properties from it because they are both its determinates. One advantage of this theory is that it offers a view on what a conjunction is: as a mereological sum is the mere composite of all its parts, so a conjunction is just the mere composite of its conjuncts.

This theory of conjunction clears the way for the thesis that conjunction occurs nearly universally. I.e.,

(T3) For any facts, there is some fact such that each of them either is it or is one of its conjuncts.

Indeed, more strongly:

(T3*) For any facts, there is some fact such that each of them is one of its conjuncts.

However, only the weaker version, T3, is needed for what follows.

There are some facts which are all of the facts. When T3 is applied to these facts (which facts? all of them!), it entails that there is some fact such that every fact, other than itself, is one of its conjuncts. Call this hypothetical proposition the Master Fact. (Cf. Fine 1982; Gale and Pruss 1999, 2002; Oppy 2000; Almeida and Judisch 2002; Pruss and Gale 2003; Pruss 2006; Alexander 2008; and Koons 2014.) If conjunctions were not conjuncts of themselves, we'd want to know why the Master Fact could not be conjoined with one of its own conjuncts in order to compose another conjunctively larger fact which was not, apparently, a conjunct of the Master. Or else we'd be concerned that in order

for that purportedly larger fact actually to be included as a conjunct of the Master, the Master Fact would have to turn out to be a conjunct of a conjunct of itself.

This result looks very strange, so long as we are still thinking of conjuncts as components of sentences. It is not so strange against the backdrop of the view that conjuncts are components of propositions and the relationship of conjunction is a mere putting together of the conjuncts. Here, by analogy to mereological summation, it is plausible that all conjunctions are self-conjuncts, just as all entities whatsoever are self-parts, and therefore every conjunction is a conjunct of some of its own conjuncts.

MIP has one further important consequence, which becomes clear by means of a worry. According to MIP, if P and Q are numerically distinct, then P&(P&Q) = P&Q. This should cause concern. Don't P and P&Q explain the conjunction P&(P&Q) through &-introduction? If they do, then they explain it through &-introduction either fundamentally or else non-fundamentally, and either side will create a problem.

First, suppose P and P&Q explain P&(P&Q) non-fundamentally through &-introduction. According to MIP, this means that P and P&Q explain P&Q non-fundamentally through &-introduction. In other words, the mere fact of that P and P&Q conjoin into P&Q is a genuine explanation of P&Q, and it succeeds in being explanatory solely in virtue of some other explanation or explanations.

It is difficult to see how this might go. I see only one fairly plausible account as to what other explanation or explanations there might be such that P and P&Q manage solely in virtue of them to explain P&Q by conjoining into P&Q. The proposal in question is that P and P&Q explain P&Q by &-introduction solely in virtue of the explanation by &-introduction from P and Q to P&Q.

This proposal has something in its favor. Given three discrete facts P, Q and R, it does seem plausible that P&Q and Q&R might explain (P&Q)&(Q&R) by &-introduction and, therefore by MIP, that they might explain P&Q&R by &-introduction. It is also plausible that if they explain P&Q&R by &-introduction, then they do so exhaustively in virtue of P, Q and R's explanation of P&Q&R by &-introduction. This assessment, if accepted, suggests the following rule: whenever some discrete premises explain a consequence by &-introduction, they do so solely in virtue of the conjunction of those premises' proper conjuncts into that consequence by &-introduction. We might even drop the word "discrete" to get a more general principle.

One case of this general rule would be that if the conjunction of P and P&Q into P&Q is explanatory, then that explanation obtains solely in virtue of the conjunction of P and Q into P&Q. So the intuitive support for this general rule gives some reason to think that P and P&Q might non-fundamentally explain P&Q by &-introduction.

It won't work, however. Whether or not P&Q does some explanatory work towards P&Q in an explanation of P&Q whose premises are P and P&Q, P&Q does not do any explanatory work in the explanation of P&Q by &-introduction whose only premises are P and Q. P&Q's only role in that explanation is to be explained. It itself does no explaining in the explanation from P and Q to P&Q. Consequently, if P and P&Q explain P&Q by &-introduction solely in virtue of the explanation of P&Q by P and Q by &-introduction, then there is a straightforward breach of T8:

(T8) For any non-fundamental explanation E1, there are some other explanations EE2 (none of which is E1) such that E1 succeeds in being explanatory solely in virtue

of the EE2's and for every premise P of E1, P does some explanatory work in at least one of the EE2's.

Here, E1 is the (purported) non-fundamental explanation of P&Q by P and P&Q via &-introduction, the only EE2 is the explanation of P&Q by P and Q via &-introduction, and the variable P from the statement of T8 should be given the value P&Q. If P and P&Q explain P&Q by &-introduction (that is, if E1 exists), then on the present theory, this explanation succeeds in being explanatory solely in virtue of the explanation E2 from P and Q to P&Q via &-introduction, and yet some premise of E1 (namely, P&Q) does no explanatory work in E2 (i.e., P&Q does no explanatory work in the explanation of P&Q by P and Q via &-introduction). That contradicts T8.

T8 is a formalization of the condition exhibited by the inference from the facts of the recent rain and Fermat's Last Theorem to the fact that the ground is now wet, as considered in the foregoing section 'Explanatory Irrelevance.' The inference by &-introduction from P and P&Q to P&Q fails to be explanatory for the same reason as did the rainy Fermat inference. Each of these inferences involves a 'tacked on' premise which does no work in any of the more basic explanations solely in virtue of which the larger explanation in question would succeed in being explanatory, if it did succeed at all. In the original example, the 'tacked on' premise was the truth of Fermat's Last Theorem. Now it is the conjunction P&Q.

So it is not the case that the conjoining of P and P&Q into P&Q succeeds as an explanation solely in virtue of the conjoining of P and Q into P&Q. There seems to be no other plausible candidates as to what explanation or explanations there might be solely in virtue of which the conjoining of P and P&Q into P&Q so succeeds. So we should

reject that there are any such explanations. In that case, however, P and P&Q do not explain P&Q by &-introduction non-fundamentally.

The other alternative is that P and P&Q explain P&(P&Q) by &-introduction fundamentally. However, by MIP, P&(P&Q) = P&Q. So it follows that P and P&Q fundamentally explain P&Q. This is a patent case of tail-swallowing, since the only consequence, P&Q, is one of the two premises. T2 rules this out.

To maintain MIP, then, we must somehow deny that that every instance of conjunction is explanatory. In particular, the conjoining of P and P&Q into P&(P&Q) must not be explanatory, neither fundamentally nor non-fundamentally.

Fortunately, given the background picture of MIP in which we are reasoning about facts and not mere sentences, it is intuitively plausible that P and P&Q do not, by &-introduction, explain P&(P&Q). On this picture, there is no difference at all between P&(P&Q) and P&Q. So to say that P and P&Q explain P&(P&Q) by conjoining into it is just to say that P and P&Q explain P&Q by conjoining into it. But supposing one is asked, “Why is it that I’m hungry and the Braves won the World Series?”, the response “Because of the fact that you’re hungry and the fact that you’re hungry and the Braves won the World Series” is not particularly appetizing.

What’s more, there is a simple theory about how &-introduction works which makes sense of this constraint on explanation. It reads like this:

(T13) A given instance of &-introduction is explanatory iff its premises are discrete.

P and P&Q are not discrete, and so according to T13, conjoining them into P&(P&Q) is not explanatory. The thesis also has the advantage of ruling out the explanatory status of cases like the conjoining of P&Q and Q&R into P&Q&R, which face objections similar

to those considered against the conjoining of P and P&Q into P&Q. Rather, according to T13, the instances of &-introduction which do actual explanatory work are those that conjoin facts which were originally altogether non-overlapping.

Causal Decomposition

Another important major assumption reads as follows:

(T4) Any fact which causally explains a conjunction causally explains each of its conjuncts.

This seems intuitive: to cause P&Q, you must cause P and cause Q. In addition, consider the following thesis:

(T14) What it is to causally explain each of some consequences is to causally explain those consequences; and when there is more than one consequence in question, then what it is to causally explain those consequences is to causally explain their conjunction; and vice versa.

T14 simplifies the ontology of explanation by denying the existence of these three distinctions, e.g., among (i) the causation of P by R and the causation of Q by R, (ii) the causation of P and Q by R, and (iii) the causation of P&Q. Morevoer, it is obvious that in many cases all three of descriptions hold of the same P, Q and R, and there is no clear case in which any one or two holds without the others holding also. By equating the three descriptions, T14 explains why this has turned out to be the case.

T14, of course, entails T4. So T4 is supported chiefly by its intuitive appeal, but also by being entailed by a metaphysical account (T14) which simplifies the ontology and explains the overlap among causation of each of some consequences, of those consequences, and of the conjunction of those consequences.

There is one consideration which raises doubt about T4 (and with it, T14). It concerns the disanology between causation and &-introduction. These two explanatory inferences have many commonalities, but &-introduction does not obey any analogue to

T4. From the fact that P and Q explain P&Q, it does not follow that they explain each of P and Q.

However, if &-introduction is to be distinctive anywhere --- if it is to contribute anything structurally unique to metaphysical explanation --- then it must be distinctive with respect to cases concerning conjunction, since conjunction is what &-introduction is. T4 is about conjunction. So it's a good candidate for the sort of principle with respect to which &-introduction is likely to show its distinctiveness from causation if it ever is to anywhere.

Pan-Explanation

One further major assumption is needed:

(T5) For every fact, there is a causal explanation.

Put another way: if something happens, then something causes it to obtain. If something obtains, then something causes it to obtain.

I take this thesis to be intuitive. My understanding is that to the extent that sometimes it is not accepted, that is usually due to the difficulty of finding a positive theory as to how certain facts (say, the Master Fact or the existence of God or the axioms of mathematics or the fact of the first instant of the Big Bang) could possibly be caused. Some philosophers have other more specialized objections to this thesis. My point, however, is only that in most cases when T5 is denied, it is not denied on the grounds that it is unintuitive.

Besides this, it is natural to ask “Why is that so?” in response to whatever claim is one is offered. This is to ask for an explanation for the fact on offer. It is natural to feel that something that ought to be there is lacking if no answer to this “Why?” question can be found. I think this observation supports the view that it is intuitive that every fact has an explanation. More strongly, I think the same is true with respect to the question “What brings that about?”, i.e., “What causes that to be so?”

So T5, I think, is intuitive. We also have support for T5 through induction. There are many epistemically clear cases of facts which are causally explained. I know of no epistemically clear case of any fact which isn’t. So universal induction supports the conclusion that all facts have causal explanations.

Fourthly, it is simpler to suppose that there is only one natural group of facts --- the ones which are causally explained --- than that there are two distinct natural groups: those that are caused and those that are not.

Fifthly, there is a certain beauty to a universe in which everything is caused; and, sixthly, the natural inquisitive desire to find a cause for whatever claim is offered may make causal explanation something like a ground-level desideratum in judging the rationality of a theory. A theory in which all facts were causally explained would be --- in at least this one respect --- the most rationally supported theory of all.

It seems to me, then, that we have some cumulatively significant rational reasons to embrace T5. I am not sure it could be rational to reject it, except in light of other reasons which give positive grounds for rejecting it. Part of the work of this essay is to show we don't have many of those.

Argument and Puzzle

ARGUMENT

Since there is a Master Fact (according to MIP), and since according to T5, every fact has a causal explanation, therefore there is some causal explanation for the Master Fact. An explanation has some fact or facts as its premises. So there is some fact or facts which are all the premises in some causal explanation of the Master Fact. By the definition of Master Fact, every fact which is not the Master Fact is one of its conjuncts. Therefore, by T3 ('cause a conjunction → cause each conjunct'), the fact or facts which are all the premises in any causal explanation of the Master Fact are all the premises in some causal explanation of every fact there is.

This is a well-omened conclusion. It implies that reality is, in a certain way, causally unified and can be causally explanatorily traced back to a point or some points. There is some fact or facts --- some initial points of explanation --- which, quite strictly, explain everything.

Not to say, of course, that these facts themselves are not explained. Part of what it is to have explained everything is to have explained oneself. From the fact that these facts are facts and that they causally explain every fact, it follows that they causally explain each of themselves. Not merely, then, do they causally explain every fact (including the Master Fact); but they are also self-causing at least in the sense that they causally explain each of themselves. (It does not so easily follow that each of them causally explains itself.)

PUZZLE

We are met with a paradox. How to make sense of the claim that there are some fact or facts which causally explain each of themselves, while holding onto T2 and T10?

(T3) Fundamental explanation does not eat its own tail: that is, there is no instance of the transitive closure of fundamental explanation all of whose objects are among its subjects.

(T10) Every fundamental explanation has exactly one consequence.

If there were no way to reconcile these claims with the truth of existence of some facts that explain each of themselves (and everything else also), we might have to give something up. I will try to show, though, that there is a straightforward way to hold onto all of them.

But first, though, let's discuss what won't work.

The first thing that won't work is any sort of looping among fundamental explanation. Since every fundamental explanation has exactly one consequence (T10) and no premises can stand in the transitive closure of fundamental explanation to any of themselves (T3), the premises can't explain themselves by standing at the start of any sort of series of fundamental explanations which eventually loops back, through however many webs and curlicues, to fundamentally explain any one of those premises. Lets call the facts that explain everything the All-Explainings. If the All-Explainings fundamentally explain some consequence P, then T10 and T3 forbid that consequence ever to stand at the start of a chain of fundamental explanations which has any one of the All-Explainings as its objects.

What about non-fundamental explanation --- might it loop? If it does, then the loop in question must not obtain solely in virtue of looping fundamental explanations, since it was just noted that T10 and T3 rule out fundamental loops. I see no other way to achieve a non-fundamental infinite regress, except by including an infinite regress.

An infinite regress is some propositions which are at least partially ordered (perhaps even well-ordered) by the 'explains' relation. An infinite regress 'terminates' iff one of these propositions explains neither itself nor any of the others of those propositions. For example, if P is explained by Q, which is explained by R, which is explained by S, and so on for countably infinitely many further explainers, then P, Q, R, S, … are a terminating infinite regress.

An infinite regress could fail to be well-ordered as if, for instance, P was explained by each of Q1 and Q2 (but neither of these explained the other), and Q1 was explained by each of Q1.1 and Q1.2 (neither of which explained the other) and Q2 was explained by each of Q2.1 and Q2.2 (neither of which explained the other), and so on. In this case, neither Q1 nor Q2 is explanatorily prior to the other, even though each is prior to P.

Suppose there is a infinite regress P, Q, R, … which terminates at P and all the propositions in it are discrete. P won't figure as a premise in any explanation of any proposition in the regress, since it comes at the very end and is explanatorily irrelevant. No single or finitely many other propositions from the regress could be the All-Explainers either, since for any finitely many propositions from the regress, there are further propositions prior to them which finitely many propositions in question don't explain.

But what about infinitely many propositions? This won't work either. Choose infinitely many propositions from the regress and let L* be the most explanatorily posterior of those you choose. Since these are the All-Explainers, and there is at least one fact (indeed, infinitely many) explanatorily prior to L*, therefore the infinitely many propositions in question explain some fact explanatorily prior to L*. But L* is one of the All-Explainers. So L* is one of some facts which explain some fact explanatorily prior to L*. In that case, however, L* is irrelevant to the fact in question; and by T1, it therefore cannot figure as a premise of an explanation of it. So we are forced to reject even the hypothesis that infinitely many facts from an infinite regress are the All-Explainers.

I have considered a countable, well-ordered infinite regress for the sake of simplicity. Much the same objection, however, will rule out any other sort of discrete regress as well.

TELOS

I have argued that neither fundamental loops, nor finite non-fundamental loops, nor infinite regresses of discrete propositions are viable. At least one model remains, though: an infinite regress of non-discrete propositions.

Suppose P and Q are numerically distinct, Q = P&Q, and there is no conjunct R of Q besides Q itself such that Q = P&R. This would be a case in which P was a remainderless proper conjunct of Q. It is a conjunct of Q which not identical to Q, and yet there is no other proper conjunct of Q such that Q is a conjunction of it and P.

This situation has an interesting feature. As discussed in the foregoing section 'A Theory of Conjunction,' P and P&Q do not explain P&Q, and by hypothesis, Q = P&Q. It

follows that P and Q do not explain Q. There is, however, no rule in this case by which it follows that Q does not fundamentally explain P.

Why is there no such rule? Q is a conjunct of which P is proper conjunct. In other cases we've considered, the fundamental explanation of P by Q was ruled out by the prohibition on tail-swallowing (T2). This, however, was because in the other cases considered, Q was a conjunction of discrete facts and P was one of those discrete conjuncts. In that sort of case, since those discrete conjuncts fundamentally explain Q via &-introduction, it would follow that if Q fundamentally explained one of those conjuncts (say, P) in turn, then those conjuncts would have fundamentally explained something (namely, Q) which fundamentally explained one of them (say, P). This is ruled out by the prohibition on tail-swallowing (T2).

The present case is different. By stipulation of the example, Q is not a conjunction of any discrete conjuncts. So there is no set of facts which does include Q as a member such that the conjunction of those facts is Q. No explanation which has Q itself as a premise is an explanation of Q by &-introduction (see section 'A Theory of Conjunction' above). Therefore, there is no explanation of Q via &-introduction at all. This being so, even if Q does fundamentally explain one of its conjuncts (say, P), it does not follow that the conjunct in question engages in tail-swallowing. That conjunct is not a premise of any fundamental explanation whose consequence is Q.

Suppose, then, we have an infinite regress P, Q, R, S, … which terminates at P such that each item in it is a remainderless proper conjunct of the next item in the series, much as P was a remainderless proper conjunct of Q in the example just given. These propositions are not discrete, since each of them is a conjunct of the next in line. So just

as no rule we have discovered forbids Q from fundamentally explaining P in the example just given, so in the infinite regress no rule we have discovered forbids each of items in the series (except for P, of course, since it is the terminating member) from fundamentally explaining each of the earlier, P-ward members.

Let's call the conjunction of all these propositions --- P, Q, R, etc. --- Telos. These propositions are not the premises of a fundamental explanation via &-introduction of Telos, since they are not discrete, whereas &-introduction is explanatory only when it has discrete premises, according to T13. Consequently, no fundamental tail-swallowing results from the thesis that Telos itself fundamentally causally explains each of those propositions.

According to T14, in any case where some premises causally explain each of multiple propositions, those many one-consequence explanations by those premises are, taken jointly, an explanation in which those premises explain the conjunction of all those propositions. Such an explanation will be non-fundamental, since it obtains wholly in virtue of the multiple one-consequence explanations which it is taken jointly. So since Telos explains each of its own proper conjuncts, therefore all those one-consequence explanations by Telos are, taken jointly, a non-fundamental explanation by which Telos explains the conjunction of all its own proper conjuncts. So Telos non-fundamentally explains the conjunction of all its own proper conjuncts. But Telos *is* the conjunction of all its own proper conjuncts. So Telos non-fundamentally causally explains itself.

This is a model on which Telos is the All-Explainer, a self-embedded infinite efficient-causally-explanatory regress which non-fundamentally causally explains itself

and, in turn, causally explains each and every fact either fundamentally or non-fundamentally.

I have not demonstrated that there are no other models which maintain the principles developed this paper. Indeed, there are at least two such models, each of which involves ‘explanatory gunk’: an infinite regress of non-fundamental explanations with no fundamental explanations at all solely in virtue of which they obtain. Neither have I addressed the possibility that the All-Explainers are two premises instead a single one (perhaps a Telos and something else). Cogent objections exist against these alternatives, but showing that such models fail is beyond the purpose of this paper. Instead, my purpose has been to explore the most basic logical constraints on the structure of trees of metaphysical explanation and to habilitate at least one model which reconciles the intuitive premises P1, P2, P3* and P4*.

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